ARMY ENGINEER DISTRICT, SACRAMENTO SPK-03420
CORPS OF ENGINEERS Mar 83
SACRAMENTO, CALIFORNIA Revised Apr 89

TO: Architect-Engineers and District Personnel:

1. The attached revised guide specification supercedes the previous guide, PRETENSIONED PRESTRESSED CONCRETE, SPK-3A, dated March 1983, and is for use in the preparation of project specifications.

TEXT REVISION
Para 9

NOTE: A-E's should read all the TECHNICAL NOTES located at the beginning of this guide specification and edit the specification accordingly.

SPK-03420
Apr 1989

GENERAL NOTES

1. This guide specification is to be used in the preparation of contract specifications in accordance with the Sacramento District Specification Manual. It will not be made a part of a contract merely by reference; pertinent portions will be copied verbatim into the contract documents.

2. Where numbers, symbols, words, phrases, clauses, or sentences in this specification are enclosed in the following manner: [ ], a choice or modification must be made; delete inapplicable portion(s) carefully. Where blank spaces occur in sentences, insert the appropriate data. Where entire paragraphs are not applicable, they should be deleted completely.

TECHNICAL NOTES

A. The section number should be inserted in the specification heading and prefixed to each page number in the specification section.

B. Paragraph 1: The listed designations for publications are those that were in effect when this guide specification was being prepared. These designations are updated when necessary by District Instruction, and references in project specifications need be no later than in the current District Instruction for this guide specification. To minimize the possibility of error, letter suffixes, amendments, and dates indicating specific issues should be retained in paragraph 1 and omitted elsewhere in the project specification.

C. The maximum size of course aggregate shall not exceed 1-1/2 inches, except at Hill AFB, Fort Ord, and Hunter-Liggett Military Reservation, the maximum course aggregate size shall not exceed 1 inch.

D. Paragraph 6.2.1: A f'c other than 5,000 per square inch may be used if more economical. When a 7/16-inch strand is used without stress transfer devices, the ultimate strength at transfer (f'ci) shall be a minimum of 4,000 p.s.i. When a 1/2-inch strand is used, a stress transfer device shall be used.

SPK-03420
April 1989

INDEX

SECTION 03420

PRETENSIONED PRESTRESSED CONCRETE

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PRETENSIONED PRESTRESSED CONCRETE

1. APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1 American Society for Testing and Materials (ASTM) Standards:

A 36-84a	Structrual Steel.
A 148-84	Steel Castings, High-Strength for Structrual Purposes.
A 325-86a	High-Strength Bolts for Structrual Steel Joints.
A 416-86	Uncoated Seven-Wire Stress-Relieved Strand For Prestressed Concrete.
C 33-86	Concrete Aggregates.
C 150-85a	Portland Cement.
C 231-82	Air Content of Freshly Mixed Concrete by the Pressure Method.
C 260-86	Air Entraining Admixtures for Concrete.
C 309-81	Liquid Membrane-Forming Compounds for Curing Concrete.
C 330-85	Lightweight Aggregates for Structural Concrete.

1.2 American Concrete Institute (ACI) Standards:

ACI 318-83	Building Code Requirements for Reinforced Concrete.

2. GENERAL: Members shall be prestressed by the pre-tensioning method with full bonded tendons unless otherwise specified or authorized. The work shall be performed by an organization that has successfully performed previous

installations of a major nature similar to the one involved in this contract, and the work shall be under the immediate supervision of a person experienced in directing pretensioned prestressed concrete operations. All concrete work shall conform to the requirements of SECTION: CONCRETE, except as otherwise specified hereinafter.

3. MATERIALS:

3.1 Aggregate [Except Lightweight Aggregate]: Aggregate for other than lightweight concrete shall conform to the requirements of ASTM C 33. Coarse aggregate shall be well graded from fine to coarse, within prescribed limits. The maximum nominal size shall be inch.

3.2 Aggregate [For Lightweight Concrete]: Aggregate for lightweight structrual concrete shall conform to ASTM C 330. Fine aggregate conforming to ASTM C 33 may be substituted for part or all of the lightweight structural concrete fine aggregates provided the concrete meets the strength and unit weight requirements.

3.3 Cement: Portland cement shall conform to the requirements of ASTM C 150, Type I, IA, II or IIA.

3.4 Admixtures: In no event shall calcium chloride or materials that will release nitrates in solution be used. The amount of chemicals added to the mix by the mixing water, aggregate, cementitious materials and admixtures shall not exceed the following: Chlorides (as calcium chloride) - 125 grames per cubic yard. Nitrates (as ammonium nitrate) - 10 grams per cubic yard.

3.4.1 Air-Entraining Admixture: Air-entraining admixture proposed for use shall confrom to ASTM C 260 and be selected well in advance of concrete placing and shall be certified for compliance with the specification requirements. Satisfactory facilities shall be provided for the ready procurement of test samples. Air-entraining concrete shall have an air content of not more than 4 percent of the volume of the concrete as determined by ASTM Standard C 231.

3.4.2 Other Admixtures: Admixtures, other than air-entraining agents, shall be used only on approval.

3.5 Steel Anghorages and Lifting Rings: Steel clips or other end anchorage assemblies for prestressed steel strands to remain in the permanent work may be either rolled steel or cast steel. Lifting rings may be rolled steel or stranded cable. Rolled steel shall conform to ASTM Standard A 36. Cast steel shall conform to ASTM Standard A 148. Stranded cable shall be galvanized.

3.6 Prestressing Steel Strands: Prestressing steel strands shall conform to ASTM A 416. Strands which have been overstressed by coiling in small diameter rolls, have abraded, corroded, dented, or scratched surfaces, have become embrittled, or which have different heat numbers shall not be encased in concrete. Steel strands may be accepted on the basis of the manufacturer's certificate of compliance with the above specification.

3.6.1 Loss in Initial Prestress:

3.6.1.1 Working force and stress will be considered as the force and stress remaining in the prestressing steel and concrete after all loses have taken place or have been provided for; including creep and shrinkage of concrete, elastic compression of concrete in pretensioned concrete after stress transfer, creep and relaxation of steel, and all other losses peculiar to the method or system used. In lightweight concrete, losses shall be based on results of tests made with the lightweight aggregate to be used.

3.7 Reinforcing Steel: Steel reinforcement shall conform to the requirements specified in Section, CONCRETE.

4. EMBEDDED ITEMS: Inserts and embedded items shall be accurately installed and rigidly secured in place. Embedded items includes all prestressing items such as spacer bars, anchorages, stress-transfer devices, etc., as well as all inserts and embedded items required for the installation or attachment of electrical, mechanical or other items of work required by other sections of this specification. The use of power driven studs will not be permitted closer than 12 inches to any prestress steel in any prestressed concrete work. Welding of inserts and embedded items to prestress steel will not be permitted. Shop drawings showing complete details of the installation of all embedded items, including their exact location, type and manner of securing in position, shall be submitted for approval as hereinafter specified.

5. PRETENSIONING:

5.1 General: All prestressing steel shall be accurately placed. All strands shall be of the required length without splice or couplers. Welding will not be permitted. If strands are moved out of their designed position at any time, they shall be adjusted to their correct position before completion of concrete placement. Sufficient mild steel bars, chairs and spacers shall be installed to hold the strands in position while placing concrete. All prestressing steel shall be satisfactorily protected against the formation of rust or other corrosion prior to placement and at the time of placement in the work, shall be free from loose rust, dirt, grease, oil or other lubricant or substance which would impair its bond with the concrete. All strands with broken wires or showing defects shall not be used.

5.2 Records: Complete records shall be kept by the Contractor showing the procedure and order in which stressing is performed for each member, the amount of elongation, and the amount of tension applied to each strand. On the first member of each type, or a group of members of the same type, to be cast and stressed as a unit in a single casting bed, the stressing steel shall be placed, supported, tensioned, and temporarily anchored systematically in order to establish a procedure for insuring uniform results. All records of each

pretensioning operation shall be submitted to the Contracting Officer after the operation has been completed.

6. CONCRETE FOR PRESTRESSING:

6.1 General: Concrete materials and work shall conform to the requirments of Section: CONCRETE, except as herein modified.

6.2 Concrete strengths and stresses shall be as specified below.

6.2.1 The minimum ultimate compressive strength of the concrete shall be pounds per square inch at transfer of prestressing force (f'ci) and pounds per square inch at 28 days (f'c).

6.2.2 Camber and deflection shall be investigated so as to assure no excessive bending or camber at any time.

6.2.3 At no time shall the stress in concrete due to construction procedures exceed 60 percent of the ultimate concrete strength at the time of stress.

6.4 Tolerances: Dimensional tolerances in finished members (castings) and location of prestressing steel shall be as shown on the drawings and unless otherwise shown or noted the following tolerances shall be held:

0 - 2 Feet --- 1/8-inch
2 - 5 Feet --- 3/16-inch
Over 5 Feet --- 1/4-inch

The above tolerances do not apply to conditions noted below:

6.4.1 The depth of floor and roof slab members (castings) shall be such that after installation the floor or roof slab surface shall not vary more than 1/8-inch in 10 feet longitudinally or transversely with respect to any one member of across adjacent members. Variations between members in place shall not exceed 1/8-inch at any point. Approval must be obtained to deviate from these roof and floor surface tolerances where the slabs are to receive poured-in-place topping. Poured-in-place topping shall conform to the requirements of Section, CONCRETE.

6.4.2 Clear space between roof or floor members or between roof or floor members and other construction, shall not exceed 1/4 inch at any point.

6.4.3 Variation in length of structural members, roof panels, floor penels, etc. as installed shall not vary more than 1/2 inch from the lengths indicated on the drawings.

6.5 Finishes:

6.5.1 General: Poured-on-place topping, enclosures and other concrete work and finishes not an integral part of pretensioned members, and the finish of all formed surfaces of pretensioned units shall conform to the requirements of Section, CONCRETE.

6.5.2 Floor and Roof Slab Finishes: Finished floor and roof slab surfaces shall be true plane surfaces within tolerances hereinbefore specified. The units shall be cast in forms that are tight and smooth, they shall be free of honeycomb, rock pockets, blemishes caused by excessive form leakage and large or numerous spalls.

7. INSTALLATION OF PRECAST PRESTRESSED MEMBERS:

7.1 Identification and Markings: All joints, beams, girders and other precast prestressed members shall be marked as shown on the placing drawings indicating the date of casting and the length, size and type of main reinforcement steel and prestressing steel used in the unit when such steel varies in similar units and external identification is necessary.

7.2 Transporting and Handling: After curing, units shall be stored, stacked, loaded and transported, unloaded, placed, so that no transverse or longitidunal cracks will develop. Unless otherwise specified or approved, the finished members shall be lifted and/or supported at the points shown on the approved shop drawings, or at the supporting points of the member as when installed in final position.

7.3 Bearing and Anchorages: Cast-in-place concrete shall conform to the requirements of Section, CONCRETE. Steel construction shall conform to the requirements of Section, STRUCTRUAL STEEL. Bearing and anchorage shall be in accordance with the details shown on the drawings unless otherwise approved by the Contracting Officer. Welding shall conform to the requirements of American Welding Society Standards including qualification test of welders and welding machines. Welding will not be permitted adjacent to prestressing steel, except under strict control as approved. Bolts and nuts shall be high-tensile strength conforming to the requirments of ASTM A 325, unless otherwise approved.

7.4 Poured-in-place Closures: All poured-in-place concrete enclosures and other structural concrete or poured-in-place items shall conform to the requirements of Section, CONCRETE.

7.5 Placement: All precast prestressed concrete members shall rest solidly upon all bearings. Bearing plates, where shown on the drawings or required, shall be set in non-shrinking, hard-setting mortar. The precast prestressed members shall be brought to the required line or grade before poured-in-place concrete is placed.

8. SHOP DRAWINGS: Shop drawings and design calculations shall be submitted in accordance with the SPECIAL CLAUSES. The shop drawings shall show complete details of the prestressing members including the location of pick-up-points,

the arrangement of the prestressing steel in the members, methods of maintaining strand alignment, details of end anchorages and method of prestressing the stressing steel; the arangement of mild steel reinforcement including stirrups and particularly detils of anchoring or jointing steel for

connections of joining members of other construction; complete details of form or false work and any other special features; and the method of identification and marking. In addition to the shop drawings, data shall be submitted for approval describing the proposed method of erecting the members; describing equipment to be used, method of transporting, sequence of operations, site layout and other pertinent construction data. Submitted calculations shall demonstrate that members are designed in accordance with ACI 318 for all loading conditions. If shoring is required design calculations shall reflect the conditions. Also, complete specifications shall be furnished for all materials used, a detailed description for control of strand length and control of concrete test samples. Approval of shop drawings, details, construction operations and design calculations will not relieve the Contractor of his responsiblility for completing the work satisfactorily in accordance with these specifications and within the contract time. After approval, shop drawings and data shall not be changed, nor shall construction operations be deviated from unless and until resubmitted and reapproved.

9. CONSTRUCTION QUALITY CONTROL: Attention is directed to SECTION: CONSTRUCTION QUALITY CONTROL which requires the Contractor to perform quality control inspection, testing, and reporting.

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- REMINDER -

Located at the front of these specifications are the Contract Clauses, Special Clauses and Division I GENERAL REQUIREMENTS of the Technical Specifications, which apply to every aspect of this contract including the work in this section whether performed by Prime Contractor, subcontractor, or supplier.